# TCS 140

**Portable Temperature Calibrator**

Instruction Manual MM

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## EMC INFORMATION

This product meets the requirements of the European Directive on Electromagnetic Compatibility (EMC) 89/336/EEC as amended by EC Directive 92/31/EEC and the European Low Voltage Directive 73/25/EEC, amended by 93/68/EEC. To ensure emission compliance please ensur that any serial Communications connecting leads are fully screened.

The product meets the susceptibility requirements of EN 50082-1,

criterion B.

| Symbol Identification | Publication | Description |
|---|---|---|
| | ISO3864 | Caution<br>(Refer to Handbook) |
| | IEC417 | Caution, Hot Surface |

## ELECTRICAL SAFETY

**This equipment must be correctly earthed.**

**This equipment is a Class 1 Appliance. A protective earth is used to ensure the conductive parts can not become live in the event of a failure of the insulation.**

**The protective conductor of the flexible mains cable which is colored green/yellow MUST be connected to a suitable earth.**

**The blue conductor should be connected to Neutral and the Brown conductor to Live (Line).**

**Warning: Internal mains voltage hazard. Do not remove the panels.**

**There are no user serviceable parts inside. Contact your nearest E Instruments agent for repair.**

**Voltage transients on the supply must not exceed 2.5KV.**

**Conductive pollution, eg. Carbon dust, must be excluded from the apparatus.**

**EN61010 pollution degree 2.**

## ENVIRONMENTAL RATINGS

Operating Temperature 5-50°C

Relative Humidity 5-95%, non condensing

## INSERT WARNING:

The inserts are specially processed for use with the TCS 140. It is important that only inserts supplied by E INSTRUMENTS are used. Failure to comply with this information may result to damage the TCS 140 which would not be covered under warranty.

## HEALTH AND SAFETY INSTRUCTIONS

1. Read all of this handbook before use.
2. Wear appropriate protective clothing.
3. Operators of this equipment should be adequately trained in the handling of hot and cold items and liquids.
4. Do not use the apparatus for jobs other than those for which it was designed, ie. the calibration of thermometers.
5. Do not handle the apparatus when it has hot (or cold), unless wearing the appropriate protective clothing and having the necessary training.
6. Do not drill, modify or otherwise change the shape of the apparatus.
7. Do not dismantle the apparatus.
8. Do not use the apparatus outside its recommended temperature range.
9. If cased, do not return the apparatus to its carrying case until the unit has cooled.
10. There are no user serviceable parts inside. Contact your nearest E Instruments agent for repair.
11. Ensure materials, especially flammable materials are kept away from hot parts of the apparatus, to prevent fire risk.

## GUARANTEE

This instrument has been manufactured to exacting standards and is guaranteed for twelve months against electrical break-down or mechanical failure caused through defective material or workmanship, provided the failure is not the result of misuse. In the event of failure covered by this guarantee, the instrument must be returned, carriage paid, to the supplier for examination and will be replaced or repaired at our option.

**Fragile ceramic and/or glass parts are not covered by this guarantee**

**Interference with, or failure to properly maintain this instrument may invalidate this guarantee**

## RECOMMENDATION

The life of your **E INSTRUMENTS** Instrument will be prolonged if regular maintenance and cleaning to remove general dust and debris is carried out.

We recommend this instrument to be re-calibrated annually.

The company is always willing to give technical advice and assistance where appropriate. Equally, because of the program of continual development and improvement we reserve the right to amend or alter characteristics and design without prior notice. This publication is for Information only.

## CAUTIONARY NOTE

**E INSTRUMENTS products are intended for use by technically, trained and competent personnel familiar with good measurement practices.**

**It is expected that personnel using this equipment will be competent with the management of apparatus which may be powered or under extremes of temperature, and are able to appreciate the hazards which may be associated with, and the precautions to be taken with, such equipment.**

## INSTRUMENT CODES

### TCS 140 cat. - A - B - C

| Table A | Options |
|---|---|
| 0 | none |

| Table B | Power supply and type of plug |
|---|---|
| 1 | 120 V 50/60 Hz Plug USA |
| 2 | 230 V 50/60 Hz Plug Schuko |
| 3 | 230 V 50/60 Hz Plug UK |
| 4 | 230 V 50/60 Hz Plug European |
| 5 | 100 V 50/60 Hz Plug USA/Japan |

| Table C | Calibration Certificate |
|---|---|
| 1 | E Instruments Calibration |

## INTRODUCTION

The TCS 140 has been designed to be rugged and easily maintained.

By using a plug-in controller the total electronics package can be replaced in a few minutes. As can be seen from the parts list, remarkably few components have been used, each of which are easily removed and replaced. The temperature range is from 55°C below ambient to +140°C.

This model provides an isothermal enclosure in which thermometers and thermostats can be checked against the temperature indicated on the temperature controller.

For traceable calibration a standard (reference) probe should be placed into the metal blocks alongside the units under test.

The probe under test should be calibrated by comparison to the standard probe.

## UNPACKING AND INITIAL INSPECTION

Our Packing Department uses custom designed packaging to send out your unit, but as accidents can still happen in transit, you are advised, after unpacking the unit, to inspect it for any sign of shipping damage, and confirm that your delivery is in accordance with the packing note. If you find any damage or that part of the delivery is missing notify us or our agent, and the carrier immediately. If the unit is damaged you should keep the packing for possible insurance assessment.

## ELECTRICITY SUPPLY

Before connecting to the electricity supply please familiarize yourself with the parts of the handbook relevant to your model.

Your unit's supply voltage requirement is specified on a plate on the instrument along with the serial number. All TCS 140 instruments will work on an electricity supply frequency of 50Hz or 60Hz.

The apparatus is provided with an approved power cord. If the plug is not suitable for your location then the plug should be removed and replaced with an appropriate plug.

Take care to ensure the old plug is disposed safely. The cable is color coded as follows:

| COLOR | FUNCTION |
|---|---|
| Green/yellow | Earth (Ground) |
| Brown | Live (line) |
| Blue | Neutral |

Please ensure that your unit is correctly connected to the electricity supply.

**THE APPARATUS MUST BE CORRECTLY EARTHED (GROUNDED)**

The unit's on/off switch is located on the front panel. Take care NOT to switch the unit off when it is hot. It's necessary allow to cool first.

## SPECIFICATION

| | |
|---|---|
| Voltage | 230VAC (or 115VAC) see ratings plate |
| Power | 200 W |
| Supply Frequency | 50/GOHz |
| Maximum Operating Temperature | +140°C |
| Minimum Operating Temperature | - 55°C (55°C below ambient) |
| Stability<br>(Absolute over 30 Minutes) | Metal Block Bath: ±0.03°C<br>Stirred Liquid: ±0.025°C<br>Black Body Source: ±0.3°C<br>Surface Sensor Calibrator: ±0.5°C |
| Calibration Volume | 35mm dia by 160mm deep |
| Standard Insert Hole Dimensions: | 2 x 4.5mm dia<br>2 x 6.4mm dia<br>1 x 9.5mm dia<br>1 x 8mm dia |
| Insert Options | Special drilling available for customer requirements. |
| Dimensions (not including handle) | Height 300mm<br>Width 340mm<br>Depth 170mm |
| Weight | 14.2Kg |

## INITIAL TESTING

This unit was fully tested before dispatch to you but please check its operation as outlined below.

After connecting the TCS 140 to the electricity supply, the temperature controller display will show the temperature of the block and the last set-point value. The controller goes through a self-test sequence first. The fan on the front panel should be heard running.

Change the set-point to 50°C and observe that the block temperature rises and settles to this value. Place a thermometer in an insert in the block and connect it to the suitably configured indicator. Confirm that the indicator agrees within ±2°C of the controller.

Change the set-point to 0°C, this should cause the second controller output to operate. Compare again with the thermometer.

Your unit should have performed as described above and can now be used for calibration.

If any problems or faults arise during these tests please contact us or our agents for help and advice.

**IMPORTANT NOTÍCE**

The controller's function settings are preset and will not require adjustment.

## MODE OF OPERATION

### 1) METAL BLOCK BATH

The metal block bath function of the TCS 140 is well suited for fast, convenient, mess free calibration of temperature sensors.

The TCS 140 metal insert is placed into the calibration well. The stir speed control should be set to the OFF position (turn fully anti-clockwise).

The thermometers under test are placed into suitable holes in metal insert.

A calibrated reference probe should be placed into the insert and the actual temperature can be read from a standard temperature indicator.

For traceable calibration the actual value of the insert temperature should be recorded along with the values from the sensors under test.

### 2) STIRRED LIQUID BATH

The stirred liquid bath function of the TCS 140 is well suited for odd shaped sensors, which will not easily be accommodated, in a metal insert.

The TCS 140 Liquid Container is placed into the calibration well and the container is filled with a suitable liquid. The container should be filled to 25mm from the top of the tank.

Care must be taken to adjust the level as the liquid contracts or expands with temperature changes. The stirrer speed control is set ON and to the mid position. If necessary the speed to can be adjusted to give the optimum value

for a particular application, this position should be found experimentally and then noted for future use.

The thermometers under test are placed into the liquid. An accessory is available to support the thermometers. The Thermometer Support Kit allows three thermometers with a diameter of 2 to 6.5mm to be suspended in the liquid, including liquid in glass types.

This accessory it is important to prevent the probes from reaching the bottom of the tank which would stop the stirring action.

A calibrated reference probe should be placed into the liquid and the actual temperature can be read from a standard temperature indicator.

For traceable calibration the actual value of the insert temperature should be recorded along with the values from the sensors under test.

The Stirred Liquid Bath can be used as a Stirred Ice Bath. The liquid container is filled with water, the stirrer speed control set to mid-position and the controller set to 0.0°C. Once the controller has stabilized at 0.0°C wait 10-15 minutes before starting calibration.

## 3) **BLACK BODY SOURCE**

The black body function of the TCS 140 is well suited for fast, convenient, mess free calibration of infrared temperature sensors.

The TCS 140 black body target is placed into the calibration well. The stirrer speed control should be set to the OFF position.

The units under test should be aligned with the target.

A calibrated reference probe should be placed into the hole in the block and the actual temperature can be read from the temperature indicator to which the infrared thermometer(s) are compared.

## 4) **SURFACE SENSOR CALIBRATION**

The surface sensor function of the TCS 140 is well suited for fast, convenient, mess free calibration of most surface temperature sensors.

The TCS 140 surface sensor insert is placed into the calibration well.

The stir speed control should be set to the OFF position.

A calibrated probe is placed in the pocket of the surface sensor insert and connected to a standard temperature indicator.

Surface sensors are placed on top of the insert and when stable compared to the calibrated probe.

## MAINTENANCE

Turn the electricity supply off before attempting any cleaning operation.

The only moving parts are the fans. They have sealed-for-life bearings. Depending on the environment in which it is used, periodic cleaning is recommended. Cleaning may be accomplished by the use of a small dry paint brush.

The instrument should be periodically checked to ensure it is in good order both mechanically and electrically.

## THE BASIC WORKINGS OF THE TCS 140

The purpose of the TCS 140 models is to provide an adjustable isothermal enclosure for calibration purposes.

The isothermal enclosure consists of a fixed heater block into which an insert can be placed. Items for calibration are placed in suitably drilled holes in the insert. The replaceable inserts enable a variety of items to be calibrated.

The heater block houses some peltier cells and the control sensor used by the temperature controller to sense the block temperature. To obtain and maintain a required temperature the controller varies the power to the peltier cells via a specific electronic device.

There are two electrically driven fans in the unit. One runs continuously and cools the electronics in the instrument and the other fan cools the heater block when called upon to do so by the temperature controller. This second fan is operated by the controller to cool the heater block when the set point is 5°C or more lower than the block temperature, when this second fan is on, the output 2 indication appears on the controller to signify this. This is normal and is not a fault condition.

## OPERATING PROCEDURES

The following operating procedures have been written for one of the two models as indicated by the Procedures heading. However the procedure may be common to the other models and in such cases the relevant models are indicated in brackets.

Please note:

- No oils, greases or powders should be introduced into the TCS 140 or

its inserts.

- Only use E INSTRUMENTS supplied inserts.

The inserts are specially plated for use in the block. Using non- E INSTRUMENTS inserts may lead to failure of the block and cause the insert to seize in the block.

## CHECKING USING THE TEMPERATURE INDICATED ON THE CONTROLLER

1. Remove the TCS 140 from its case and visually inspect it for any damage it may have sustained since it was last used. Insert the required metal insert into the furnace block using the tool supplied to avoid damage to the heater assembly.

2. Connect the TCS 140 to a suitable power supply and set the controller to the required temperature.

3. Place the thermometer for calibration into a suitable hole in the metal insert and wait for the temperature to stabilize.

4. When the temperature indicated by the controller and the output of the thermometer are both stable (see specification for typical values) record three sets of readings over a period of about six minutes. Check that these readings are consistent and then calculate their average values.

5. If the TCS 140 has itself been calibrated, correct the average values accordingly.

6. Reset the controller and/or repeat the calibration for another thermometer.

7. When the calibration is complete, reset the controller to ambient temperature and wait until the unit has cooled before moving the TCS 140 to a new location. The TCS 140 must be cooled below 80°C before it can be put back into its carrying case.

## CALIBRATION USING A STANDARD THERMOMETER WITH EXTERNAL INDICATION

1. Remove the TCS 140 from its case and visually inspect it for any damage it may have sustained since it was last used. Insert the required metal insert into the furnace block using the tool supplied to avoid damage to the heater assembly.

2. Connect the TCS 140 to a suitable power supply and set the controller to the required temperature.

3. Place the thermometer(s) for calibration and the standard thermometer into suitable holes in the metal insert; wait for the temperature to stabilize.

4. When the temperature indicated by the controller and that of the other thermometers are stable (see specification for typical values) record three sets of readings over a period of about six minutes. Check that these readings are consistent and use their average values for the final calibration figures. Compare the units under test to the standard thermometer.

5. Reset the controller and/or repeat the calibration for another thermometer.

6. When the calibration is complete, reset the controller to ambient temperature and wait until the unit has cooled before moving the TCS 140 to a new location. The TCS 140 must be cooled below 80°C before it can be put back into its carrying case

## TROUBLE SHOOTING

**Unit fails to operate**
Check fuse. If fuse blows repeatedly consult E INSTRUMENTS or local agent.

**Unit unstable**
Control parameters have been interfered with - consult your local agent.

**Cannot establish PC Communications**
For RS485 you must use the E INSTRUMENTS adaptor cable.
Ensure the addresses of the controller and indicator match those set in the software.
Ensure each controller and indicator is set to a unique address.

## ACCESSORIES PARTS LIST

| Description | E INSTRUMENTS Code |
|---|---|
| Standard Platinum Resistance Thermometer | |
| Undrilled Insert | |
| Standard Insert | |
| Special Insert | |
| Fuse 230 VAC models | |
| Fuse 120 VAC models | |
| Vinyl Case | |

## APPENDIX 1

**INDICATOR CONFIGURATION (Reference Only)**

**Config.INST**

| Name | Description | Value |
|---|---|---|
| unit | Instrument Units | •C(0) |
| dEcP | Decimal Places in Display | NN.NN |
| CtrL | Control Type | PID (0) |
| Act | Control Action | REV (0) |
| COOL | Cooling Type | LIN (0) |
| PwrF | Power Feedback Enable | OFF (0) |
| Pdtr | Manual/Auto Transfer PD Control | NO(0) |
| FoP | Forced Output Enable | NO(0) |
| Sbrt | Sensor Break Type | SB.OP (0) |
| rnGH | Process Value High Limit | 670 |
| rnGL | Process Value Low Limit | 0.00 |

**Config.IP**

| Name | Description | Value |
|---|---|---|
| inPt | Linearisation Type | RTD |
| CJC | CJC Type | (EXT) |
| imP | Sensor break impedance | AUTO(1) |

**Config.CAL**

| Name | Description | Value |
|---|---|---|
| UCAL | User Calibration Enable | YES(1) |
| Pnt1 | User Cal Point 1 | 0 |
| Pnt5 | User Cal Point 5 | -99.00 |
| OFS1 | User Cal Offset 1 | 0.00 |
| Pnt2 | User Cal Point 2 | -99 |
| OFS2 | User Cal Offset 2 | 0.00 |
| Pnt3 | User Cal Point 3 | -99 |

| | | |
|---|---|---|
| OFS3 | User Cal Offset 3 | 0.00 |
| Pnt4 | User Cal Point 4 | -99.00 |
| OFS4 | User Cal Offset 4 | 0.00 |
| OFS5 | User Cal Offset 5 | -99.00 |

Note: User Cal values are unique to each instrument. If available set values to those from calibration certificate

**Config.AL**

| Name | Description | Value |
|---|---|---|
| AL 1 | Alarm 1 Type | OFF (0) |
| LtchI | Alarm 1 Latching | NO(0) |
| AL 2 | Alarm 2 Type | OFF(O) |
| Ltch2 | Alarm 2 Latching | NO(0) |
| AL 3 | Alarm 3 Type | OFF (0) |
| LtchS | Alarm 3 Latching | NO(0) |
| AL 4 | Alarm 4 Type | OFF (0) |
| Ltch4 | Alarm 4 Latching | IMO(O) |

**Config.HA**

| Name | Description | Value |
|---|---|---|
| i d | Module Identity | CMS (7) |
| Func | Module Function | CMS (65) |
| bAud | Baud Rate | 9600 (0) |
| Prty | Comms Parity | NONE (0) |
| rES | Comms Resolution | FUL (0) |

**Config.ïA**

| Name | Description | Value |
|---|---|---|
| id | Module Identity | LOG (3) |
| Func | Module function | NONE (0) |
| SEnS | Sense of Output | NOR (0) |

**Config.2A**

| Name | Description | Value |
|---|---|---|
| id | Module Identity | LOG (3) |
| Func | Module function | NONE (0) |
| SEnS | Sense of Output | NOR (0) |